

TRANSFORMATION (5-6 MARKS)

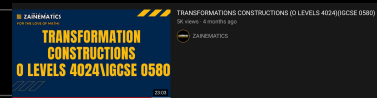
DIFFICULTY ↓
CRAMMING ↑

Tom & Jerry

- REFLECTION
- ROTATION
- TRANSLATION (DRAG)
- ENLARGEMENT
(ZOOM IN / ZOOM OUT)

FOR EVERY TRANSFORMATION MEMORIZE:

- 1) DESCRIBE
- 2) CONSTRUCTIONS (WATCH VIDEO)
- 3) ON-GRID SHORTCUTS.
- 4) MATRIX (NOT FOR IGCSE) (ONLY O LEVELS)

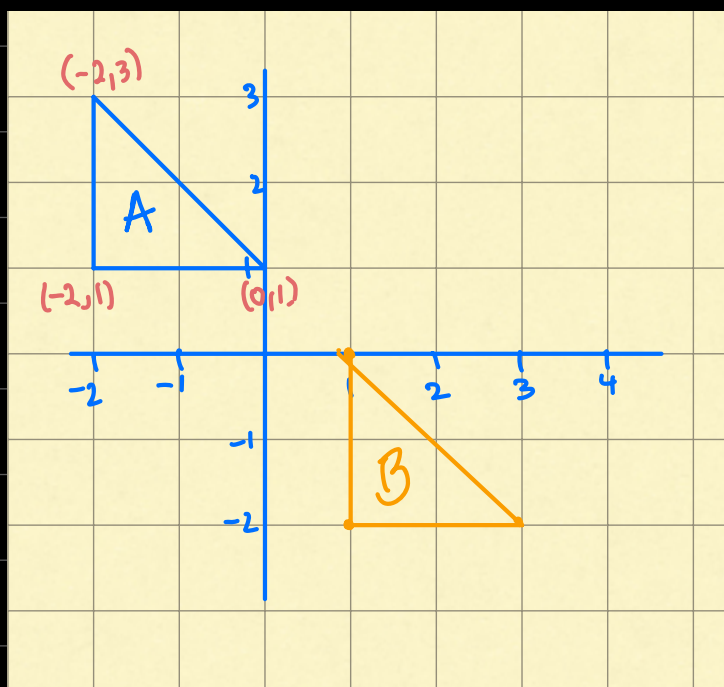
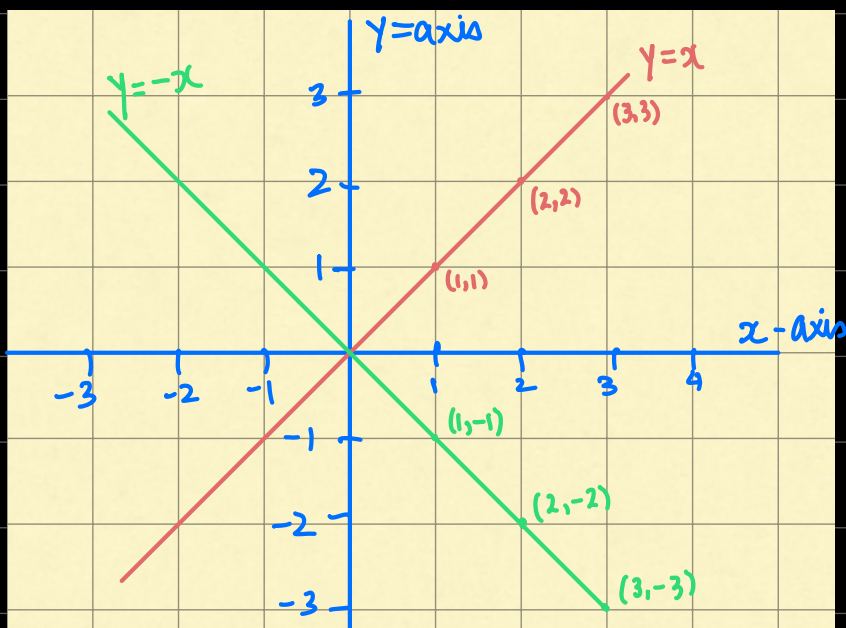


REFLECTION

- 1) DESCRIBE: EQUATION OF LINE OF REFLECTION.
- 2) CONSTRUCTIONS: (video)
- 3) ON-GRID SHORTCUTS:

A' means Image of A

	$A(1, 3)$
→ Reflection in x-axis, change y sign	$A'(1, -3)$
→ Reflection in y-axis, change x-sign	$A'(-1, 3)$
→ Reflection in $y=x$, swap both places change no sign.	$A'(3, 1)$
→ Reflection in $y=-x$, swap both places change both sign.	$A'(-3, -1)$



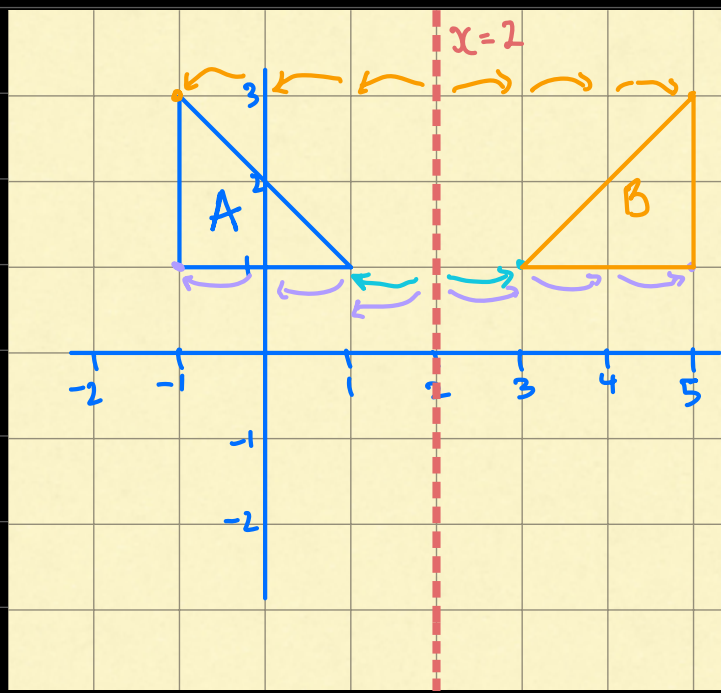
Reflect $\triangle A$ in line $y=x$. Label the image B.

SWAP BOTH PLACES, CHANGE NO SIGN

OBJECTS: $(0,1)$ $(-2,1)$ $(-2,3)$

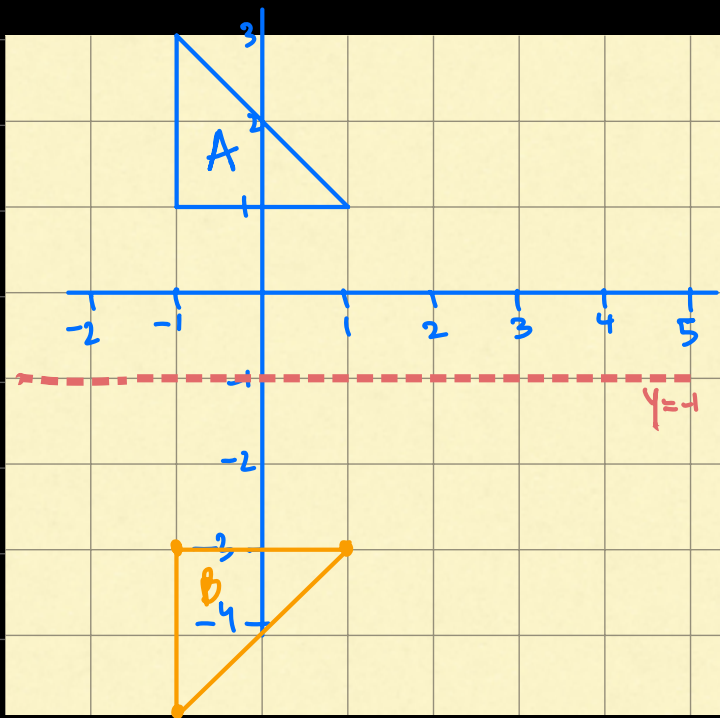
↓ ↓ ↓

IMAGE: $(1,0)$ $(1,-2)$ $(3,-2)$



Q $\triangle A$ is mapped onto $\triangle B$ by a reflection in line $x=2$

Draw and label $\triangle B$.
Vertical line



Q. $\triangle A$ is mapped on to $\triangle B$ by a reflection in $y = -1$.
 Draw and label $\triangle B$.
 Horizontal

ROTATION

- 1) DESCRIBE : (a) Centre of Rotation
 (b) Angle of Rotation
 (c) Direction of Rotation
- 2) CONSTRUCTIONS (video) (V.V.I.M.P) ←
- 3) ON GRID SHORTCUTS :

	$A(1, 3)$
Rotate 90° cw, swap both places change y -sign.	$A'(3, -1)$
Rotate 90° Acw, swap both places change x -sign.	$A'(-3, 1)$
ROTATE 180 degree, Just change signs	$A'(-1, -3)$

ROTATION

IF CENTRE OF ROTATION IS $(0,0)$

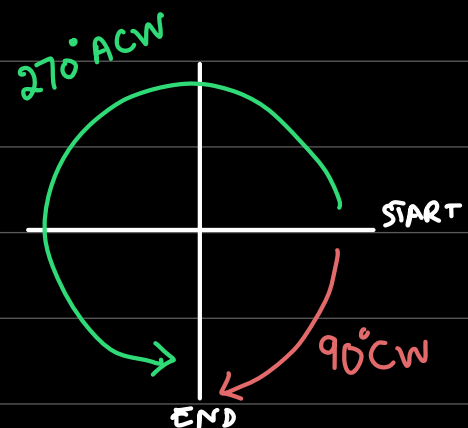
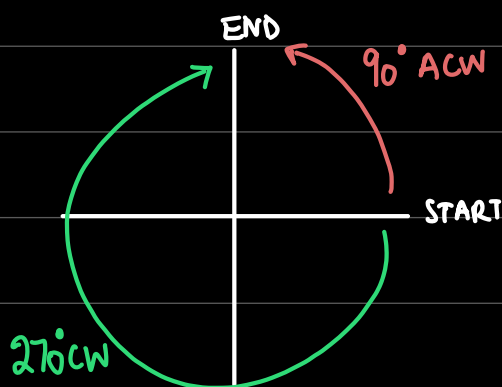
YOU ARE ALLOWED TO APPLY SHORTCUTS DIRECTLY.

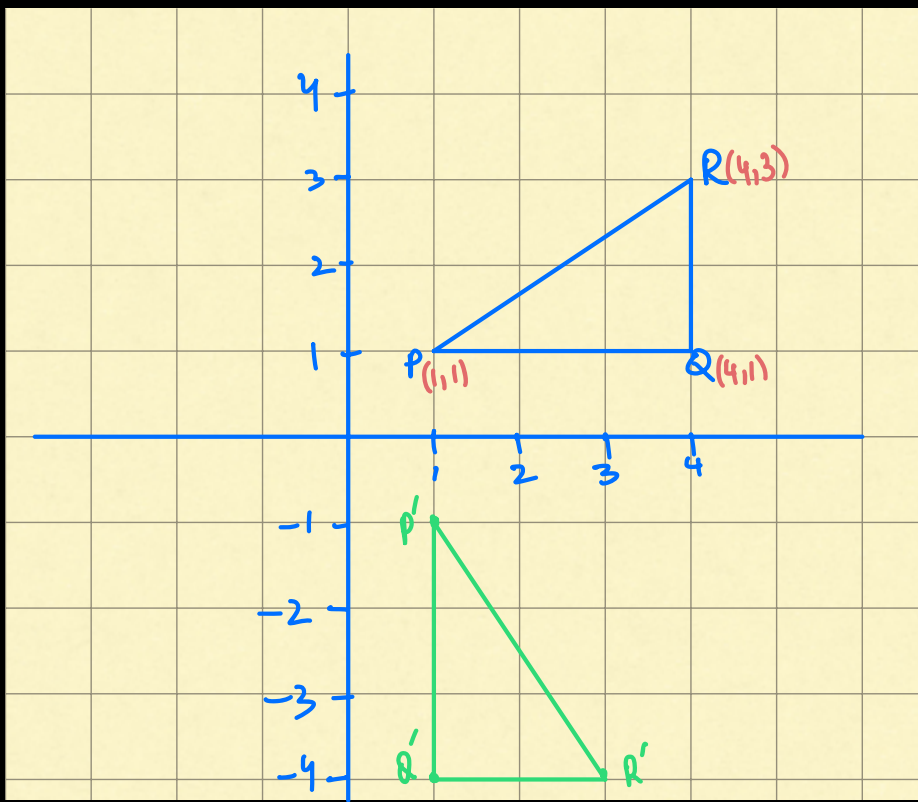
IF CENTRE OF ROTATION IS NOT $(0,0)$

THREE STEP PROCESS.

- 1- SUBTRACT CENTRE
- 2- APPLY SHORTCUT
- 3- ADD CENTRE.

IF ANGLE OF ROTATION IS NOT 90°CW , 90°ACW , 180° THIS IS DONE BY CONSTRUCTION. IT IS INCLUDED IN THE VIDEO.





Q Rotate $\triangle PQR$
 90° CW about
 centre (0,0)

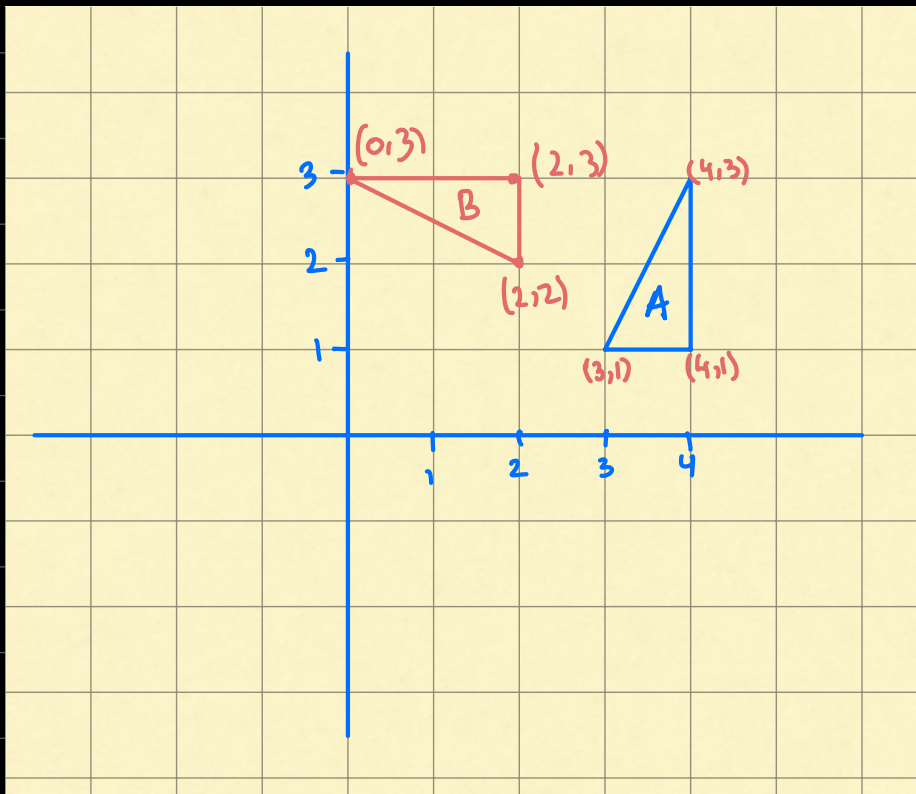
Label the image
 as $\triangle B$

Now we can apply shortcuts
 directly.

P(1,1) Q(4,1) R(4,3)

SWAP BOTH PLACES, CHANGE Y

P'(1,-1) Q'(4,-1) R'(4,-3)



Q Rotate $\triangle A$
 90° ACW about
 centre (2,1)

Label the image
 as $\triangle B$

Object .

Subtract centre

(3,1)

- (2,1)

(1,0)

(4,1)

- (2,1)

(2,0)

(4,3)

- (2,1)

(2,2)

Apply Shortcut.
Swap places, change x.

ADD Centre

Image.

↓
(0, 1)

+ (2, 1)

(2, 2)

↓
(0, 2)

+ (2, 1)

(2, 3)

↓
(-2, 2)

+ (2, 1)

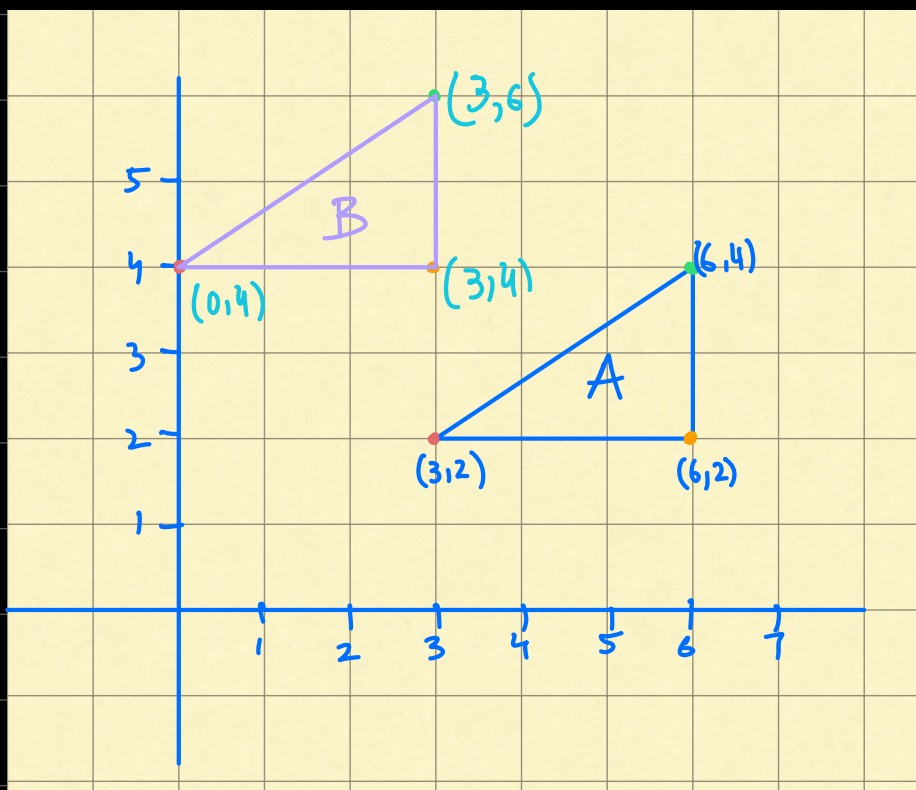
(0, 3)

TRANSLATION (DRAG)

DESCRIBE: TRANSLATION VECTOR/MATRIX

$$T = \begin{pmatrix} x \\ y \end{pmatrix} \begin{matrix} \rightarrow \text{RIGHT / LEFT} \\ \rightarrow \text{UP / DOWN} \end{matrix}$$

+ -
+ -



ΔA maps onto
 ΔB after a
translation $\begin{pmatrix} -3 \\ 2 \end{pmatrix}$

On the diagram
Draw and label
 ΔB .

$$\begin{pmatrix} -3 \\ 2 \end{pmatrix} \begin{matrix} \rightarrow \text{Left} \\ \rightarrow \text{up} \end{matrix}$$

$$\text{OBJECT} + \text{TRANSLATION} = \text{IMAGE} \\ \text{VECTOR}$$

$$\begin{pmatrix} 3 \\ 2 \end{pmatrix} + \begin{pmatrix} -3 \\ 2 \end{pmatrix} = \begin{pmatrix} 0 \\ 4 \end{pmatrix}$$

$$\begin{pmatrix} 6 \\ 2 \end{pmatrix} + \begin{pmatrix} -3 \\ 2 \end{pmatrix} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$$

$$\begin{pmatrix} 6 \\ 4 \end{pmatrix} + \begin{pmatrix} -3 \\ 2 \end{pmatrix} = \begin{pmatrix} 3 \\ 6 \end{pmatrix}$$

ENLARGEMENT

ZOOM IN - ZOOM OUT

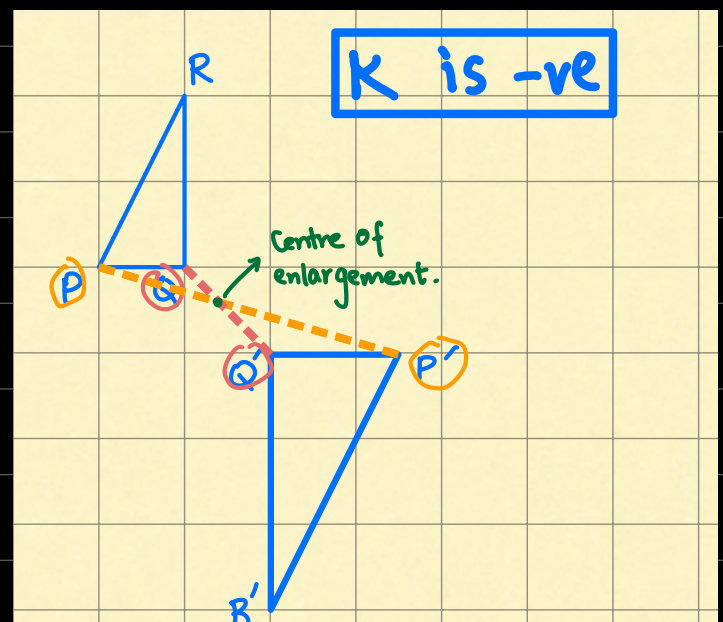
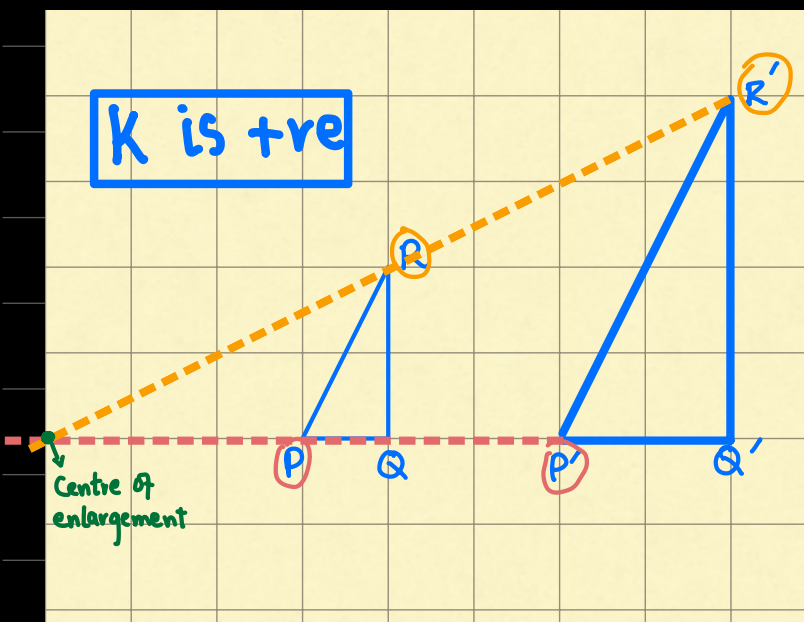
1- DESCRIBE

(a) Centre of enlargement

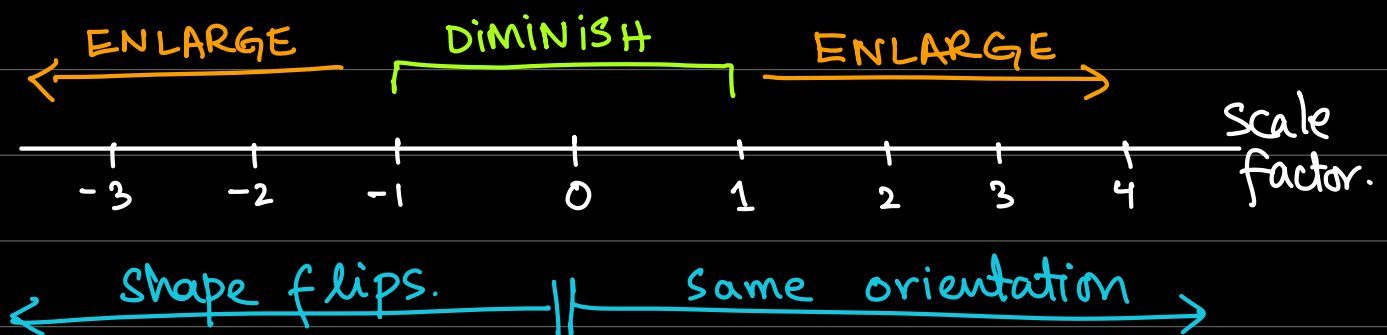
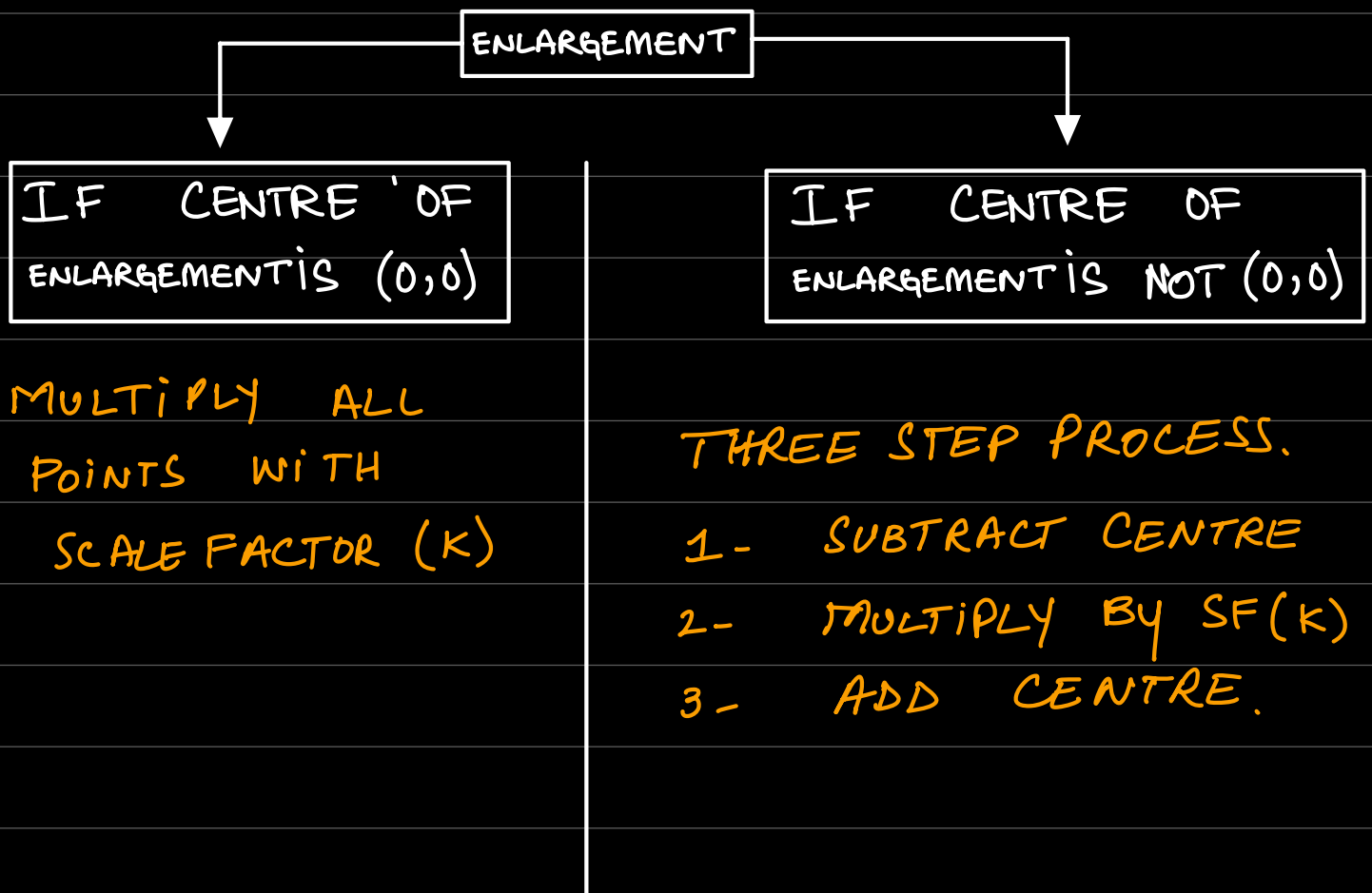
(b) Scale factor (K)

2. CONSTRUCTIONS

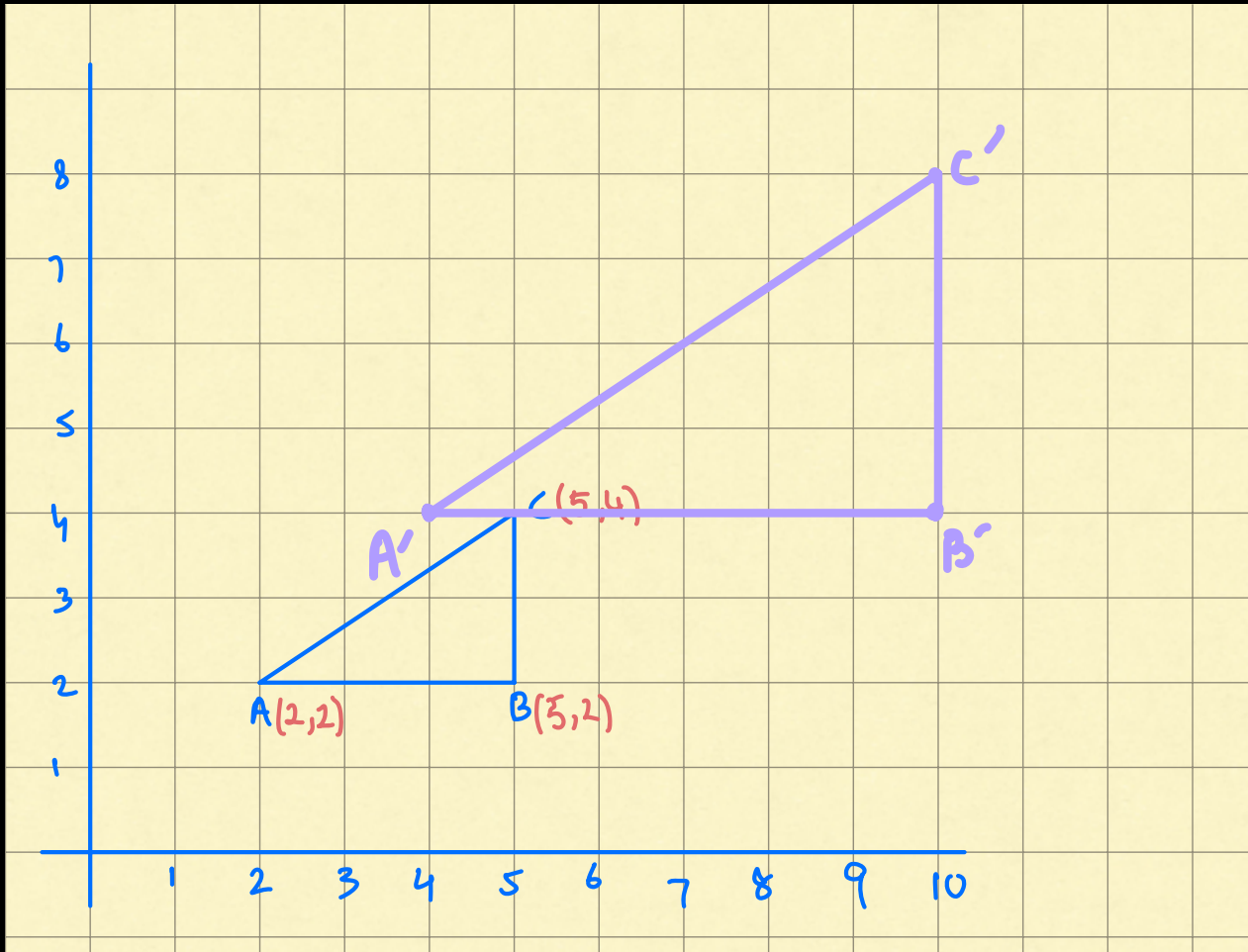
HOW TO FIND CENTRE OF ENLARGEMENT:



3- ON GRID WORKINGS.



Q: $\triangle ABC$ maps onto $\triangle PQR$ after an enlargement with centre (0,0) scale factor 2. Draw $\triangle PQR$.



$$A(2,2)$$

$$\times SF \quad 2$$

$$A'(4,4)$$

$$B(5,2)$$

$$\times SF \quad 2$$

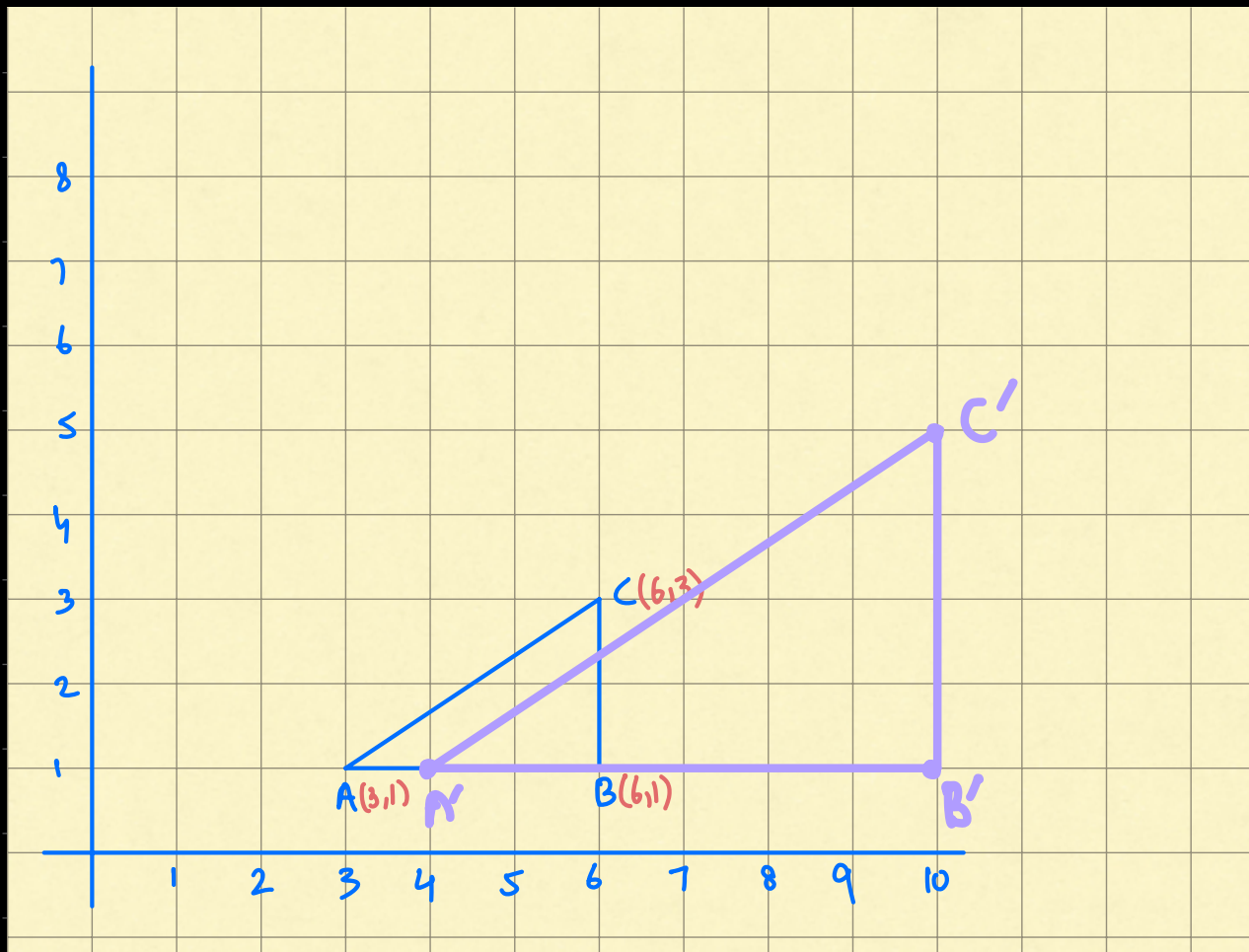
$$B'(10,4)$$

$$C(5,4)$$

$$\times SF \quad 2$$

$$C'(10,8)$$

Q) Enlarge $\triangle ABC$ with centre $(2,1)$ Scale factor 2.
Draw and label image as $\triangle P$.



Objects	$A(3,1)$	$B(6,1)$	$C(6,3)$
Subtract Centre	$-(2,1)$	$-(2,1)$	$-(2,1)$
	$(1,0)$	$(4,0)$	$(4,2)$
Multiply by SF	$\times 2$	$\times 2$	$\times 2$
	$(2,0)$	$(8,0)$	$(8,4)$
Add Centre	$+(2,1)$	$+(2,1)$	$+(2,1)$
Images	$A'(4,1)$	$B'(10,1)$	$C'(10,5)$

SCALE FACTOR (K)

$$K = \frac{\text{Image length}}{\text{Object length}} = \frac{6}{2} = +3$$

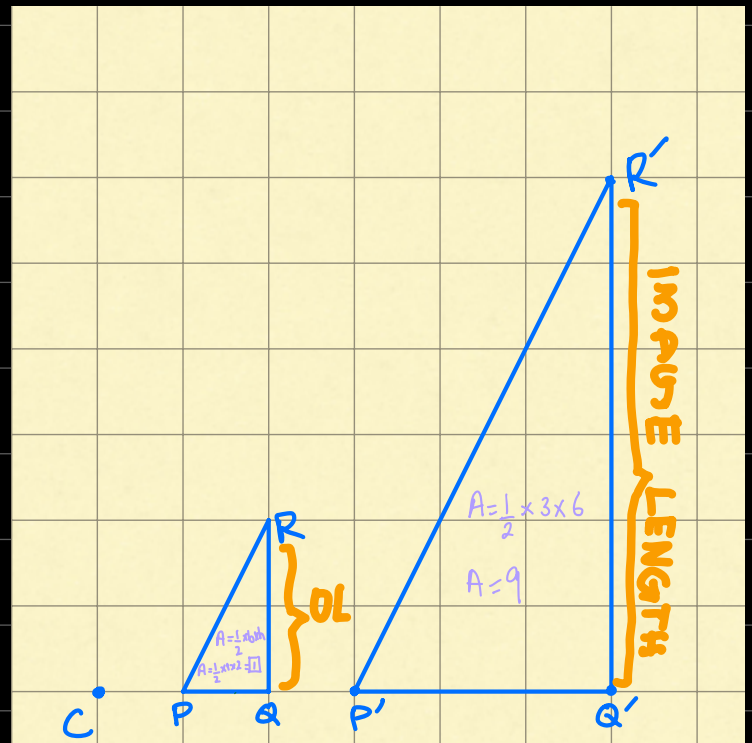
$$K = \frac{\text{Image to centre distance}}{\text{Object to centre distance}} = +\frac{3}{1}$$

$$K^2 = \frac{\text{Image Area}}{\text{Object area}}$$

$$K^2 = \frac{9}{1}$$

$$K^2 = 9$$

$$K = +3$$



object to centre $\longrightarrow$
image to centre $\longrightarrow$

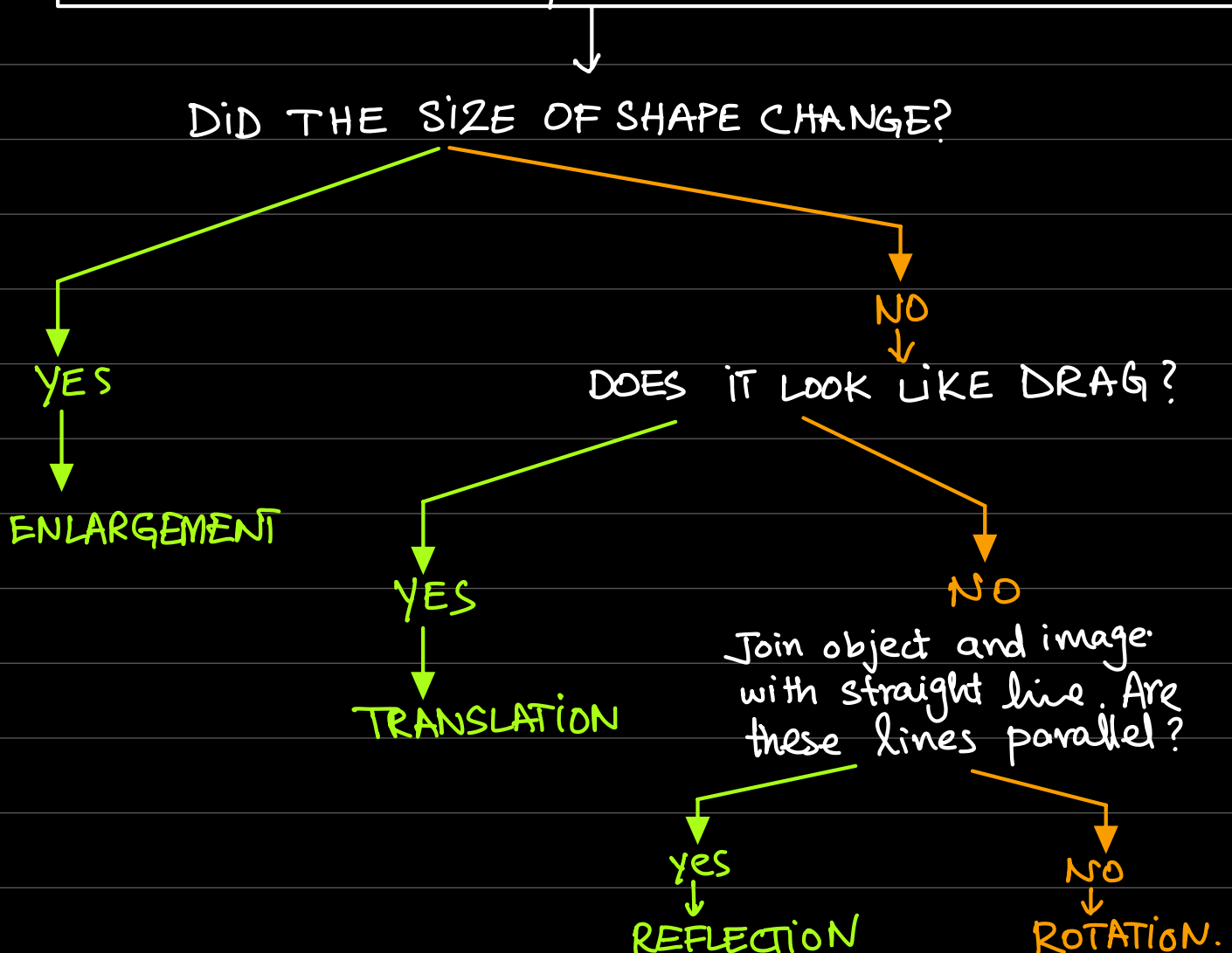
IMP IF K is +ve, centre of enlargement is on one side of both object and image.

IF K is -ve, centre of enlargement is somewhere between object and image.

DESCRIBE

1- REFLECTION	EQUATION OF LINE OF REFLECTION
2- ROTATION	1- Centre 2- Angle 3- Direction
3- TRANSLATION	Translation vector $\begin{pmatrix} x \\ y \end{pmatrix}$
4- ENLARGEMENT	1- Centre 2- Scale factor (k)

HOW TO IDENTIFY AMONG TRANSFORMATIONS



WELL!
% DONE